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AUTHOR(S):

UCHIKAWA, Kimito; MAEDA, Kishio; HARADA, Masashi; KOBAYASHI, Tsuneaki

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Bat Myobiidae from Sabah, Borneo¹⁾

Kimito UCHIKAWA, Kishio MAEDA, Masashi HARADA
and Tsuneaki KOBAYASHI

Abstract

Twenty three species, inclusive of 8 new species and 1 new subspecies, of bat Myobiidae from Sabah, Borneo, Malaysia, were recorded. The plesiotypes of *Binuncus* (*Probinuncus*) *cynopterus* Fain (male) and *Acanthophthirius* (*Myotimyobia*) *adversus* Fain (female) were designated. Some comments on host systematics and on availability of myobiids as indicators for phylogeny of hosts were annexed, showing several examples.

The host specificity of the mites of the family Myobiidae is so strict that these mites are expected to be good indices in systematics and biogeography of their host mammals. The availability and limitation of the mites as indicators should be definitely comprehended on as much material as possible. Although many suggestive informations have been compiled by Dr. Dusbábek and Dr. Fain, it is still of prior necessity to describe species and to record distribution and host relations of this promising group of mites. On this viewpoint, all the myobiids taken from Bornean bats are recorded below, expecting to shed light on phylogenetic problems among some hosts. The host bats were collected on Sabah, Borneo, Malaysia, by junior authors in 1976 and 1979.

Dr. Fain and Dr. Lukoschus are also concerned about mites parasitic on mammals in the same region, and already collected material, inclusive of bat Myobiidae. They readily left description of their new myobiid mites still later on for granting priority to this paper.

The main project that yielded the present report was started in 1976 under the name of "Taxonomical and phylogenetical study of species involved in fauna and flora of the tropical rainforest, with special reference to the mechanism of speciation" (Kobayashi and Hotta, 1978). All the bats and myobiids dealt with in this paper are a part of the collection of Kyoto University Biological Expedition to the rainforest of Sabah, which was financially supported by an Oversea Research Grant of the Ministry of Education of Japan in fiscal years of 1976 and 1978.

1. *Binuncus* (*Probinuncus*) *cynopterus* Fain, 1975 Fig. 1

Material examined. Two ♂♂, inclusive of plesiotype, 1 ♀ ex *Cynopterus brachyotis* (Müller), Gomantong, Sabah, Borneo, Malaysia, 1979-IV-3; 1 ♂ 1 ♀ from the same host, Batu Puteh, Sabah, Borneo, Malaysia, 1979-III-25.

1) Contribution from the "Kyoto University Biological Expedition to the Malesian Tropical Rain Forest" No. 6.

This species was described based on the females and nymphs taken from *Cynopterus brachyotis* (Müller) on Cotabato, Mindanao, Philippines (Fain, 1975). The females and nymphs were, then, found on *Megaerops ecaudatus* (Temminck) from Thailand (Uchikawa and Kobayashi, 1979). Here presented is the description of the male of this mite.

Male (Fig. 1). Body 460–490 μ long by 175–190 μ wide. Setae *vi* spiniform, 13 μ long; *sc i* fine and situated distinctly posterior to basal level of *sc e*; *d*₁ and *d*₂ inflated basally and 35–38 and 45–55 μ long, respectively; *d*₂ on basal level of *l*₁; *d*₃ and *d*₄ swollen, 70–80, and 55–57 μ long, respectively. Genital shield with 4 pairs of minute setae situated at center of bases of *d*₁ and *d*₂. Penis long, about 210 μ . Ventral setae *ic*_{1–4} and *cxIV* 50–55, 75–80, 85–85, 45–48 and 100–105 μ long, respectively. All legs as in female. The plesiotype is designated and deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9320).

The present species and *Binuncus balionycteris* Fain so far constitute the subgenus *Probinuncus* Fain. The females of both the mites have similar properties, but partner

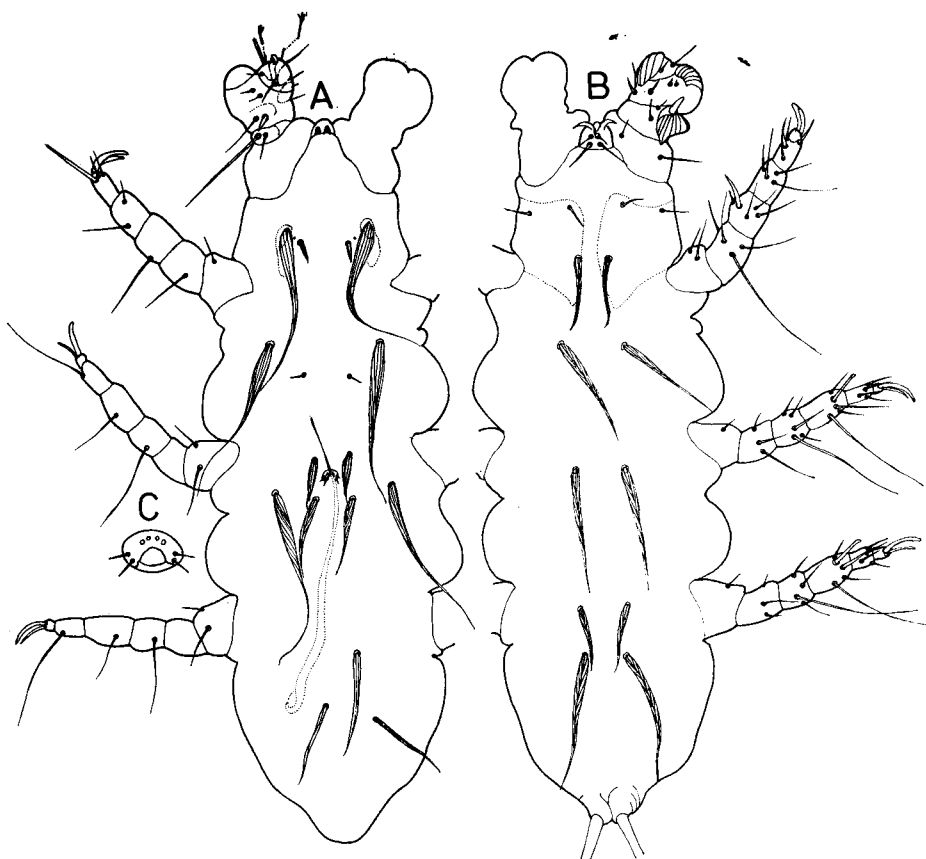


Fig. 1. *Binuncus (Probinuncus) cynopterus* Fain, male. A-dorsum; B-venter; C-genital shield.

males differ from each other remarkably in having the genital shield and penis quite differently formed and distributed.

2. *Binuncus (Binuncus) jamesoni* (Hiregaudar et Bal, 1956)

Material examined. Six ♂♂, 4♀♀ and 2 nymph ex *Eonycteris spelaea* (Dobson), Poring, Sabah, Malaysia, 1979·III·23.

3. *Pteropimyobia pahangensis pahangensis* Fain, 1973

Material examined. One ♂, 2♀♀, 2 deutonymphs and a larva ex *Macroglossus lagochilus* Matschie, Poring, Sabah, Borneo, Malaysia, 1979·II·23; 1♂ from the same host and locality, 1979·VIII·25.

4. *Metabinuncus borneoensis* sp. nov. Figs. 2-3

Material examined. Holotype male, allotype female, a male and 2 female paratypes, 4♂♂, 1♀ and 2 nymphs ex *Hipposideros galeritus labuanensis* (Tomes), Poring, Sabah, Borneo, Malaysia, 1979·III·24; 4 male and 2 female paratypes and 1♂ from the same host, Batu Puteh, Sabah, Borneo, Malaysia, 1979·III·20; 2♂♂ and a female paratype from the same host and locality, 1979·III·30; 1♂ from the same host, Poring, 1979·III·24. The holotype and allotype are deposited in the collection of the National

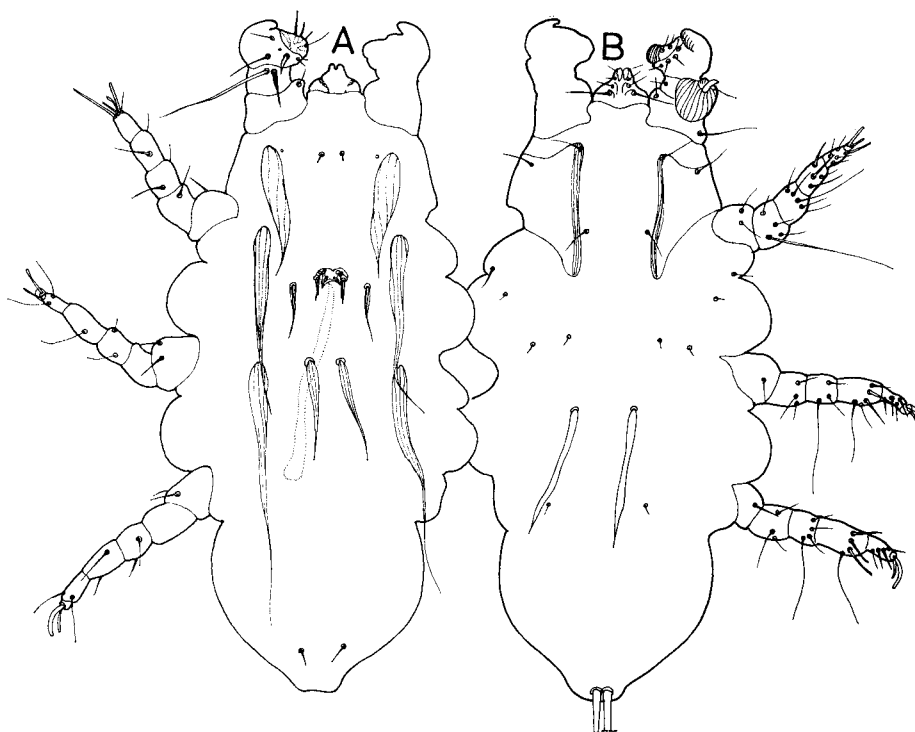


Fig. 2. *Metabinuncus borneoensis* sp. nov., male. A-dorsum; B-venter.

Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9321, 9322), and the paratypes in the collection of K.U.

Male (Fig. 2). Measurements for holotype are followed by ranges for paratypes in parentheses. Body 370 (355–365) μ long by 190 (175–190) μ wide. Setae *vi* fine, about 8 μ long; *ve* 75 (73–82) μ long and about 18 μ wide; *sc i* weakly inflated basally, 38 (30–38) μ long, situated distinctly posterior to basal level of *sc e*; *sc e* 125 (130–155) μ long; *d*₁ about 17 μ long, situated slightly anteriad from basal level of *sc i* and on genital shield; *d*₂ 58 (45–60) μ long, situated on basal level of *l*₁; *l*₁ 162 (158–175) μ long. Genital opening at level of *sc i*; genital shield bearing 3 pairs of minute setae; 3 more pairs of very minute setae probably present on the shield. Penis about 125 μ long. Ventral setae *ic*₃ inflated, 83 (68–82) μ long. Gnathosoma and legs as illustrated in Fig. 2A and B.

Female (Fig. 3). Body 450 (430–460) μ long by 230 (220–250) μ wide. Setae *vi* minute, about 10 μ long; *ve* with blunt tip, 103 (93–97) μ long; *sc i* and *sc e* each with blunt tip, 88 (80–85) and 127 (103–120) μ long, respectively; distance between *d*₁ about 25 μ and *d*₅–*d*₅ 68 μ ; *d*₂, *l*₂ and *d*₃ on line linking *d*₁ and *d*₅, and *d*₄ situated distinctly interior to this line; *d*₂, *l*₂ and *d*₃ inflated abruptly at basal one third; *d*₁–₂, *l*₂ and

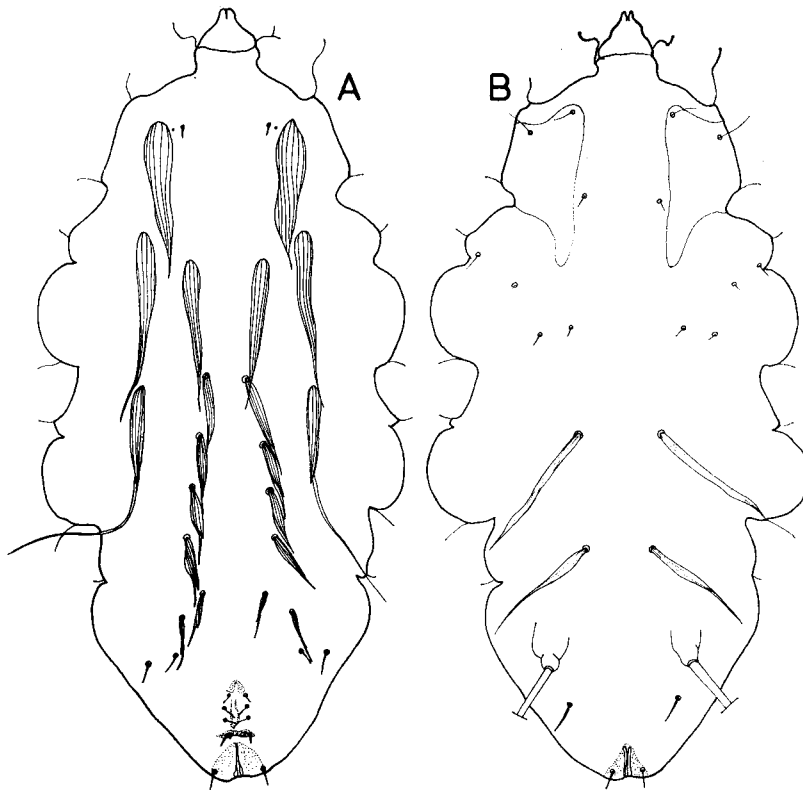


Fig. 3. *Metabinuncus borneoensis* sp. nov., female. A-dorsum; B-venter.

d_{3-5} 73 (63–70), 63 (50–59), 53 (48–53), 45 (40–43), 40 (30–36) and 40 (34–38) μ long, respectively; l_1 153 (140–155) μ ; l_3 and l_4 minute. Ventral setae ic_3 and ic_4 prominent, 103 (83–98) and 98 (75–90) μ long, respectively. Gnathosoma and legs essentially as in male. Genito-anal region as in Fig. 3A.

The genital shield of the male and arrangement of d_{1-2} , l_2 and d_{3-5} of the female are specific characters for the present new mite.

5. *Metabinuncus viduus* sp. nov.

Fig. 4.

Material examined. Holotype and paratype females ex *Hipposideros diadema* (Geofroy-St.-Hilaire), Madai Cave, Sabah, Borneo, Malaysia, 1979·VIII·10.

The holotype is deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9323) and the paratype in the collection of K.U.

Female (Fig. 4). Body 510 (holotype)–510 (paratype) μ long by 280–280 μ wide. Setae vi minute; ve 110–115 μ long; $sc\ i$ and $sc\ e$ 95–85 and 147–155 μ long, respectively; d and l series of setae not barbed; d_1 and d_2 same in nature, 80–85 and 70–70 μ long, respectively; l_2 inflated at middle, 48–55 μ long; d_3 53–60 μ long, and further apart from median line than preceding setae; d_3-d_3 48–58 μ and l_2-l_2 23–25 μ ; d_4 fine, 13–15 μ long and d_4-d_4 65–68 μ ; d_5 21–23 μ long and d_5-d_5 35–35 μ . Ventral setae ic_3 and ic_4 115–125 and 90–83 μ long, respectively. Minute sclerite embedded on medium line at level of g_1 . Genito-anal region, gnathosoma and legs as in Fig. 4A and B.

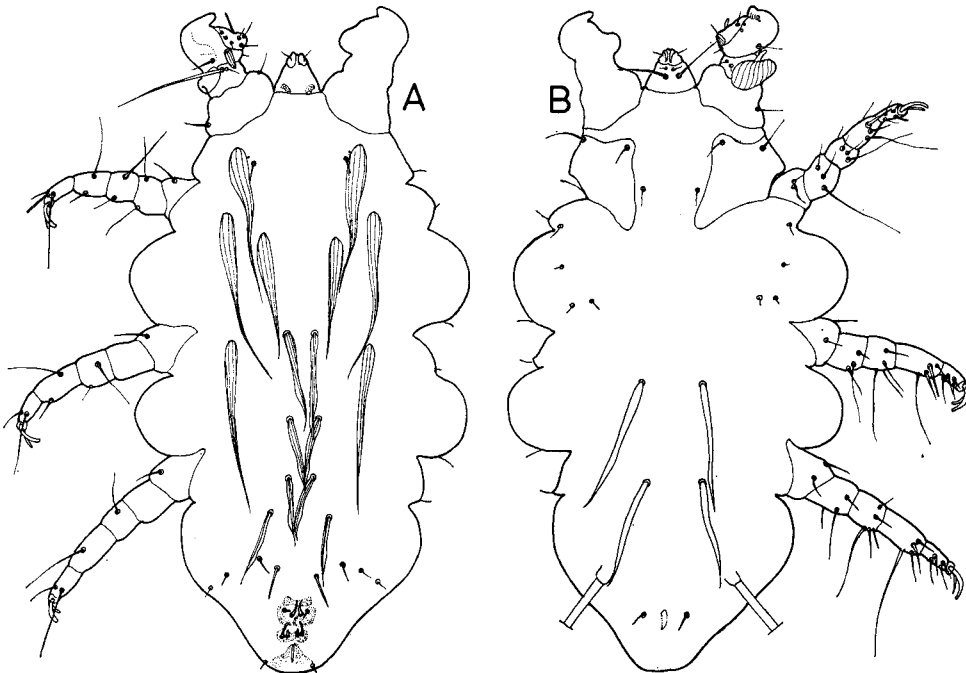


Fig. 4. *Metabinuncus viduus* sp. nov., female. A-dorsum; B-venter.

The host of the present new mite, *Hipposideros diadema* (Geoffroy-St.-Hilaire), is known to harbor *Metabinuncus novaeguineae* Fain on New Guinea (Fain, 1972, 1976). This mite and *M. viduus* sp. nov. are separable from each other in having opisthosomal dorsal setae quite differently formed and distributed. Thus, the host bat so far yielded the 2 mites of the genus *Metabinuncus*. Such an example was already reported in the case of the African bat, *Hipposideros caffer* (Sundevall), which brought out *Metabinuncus hipposideros* Fain and *Metabinuncus irangiensis* (Fain).

The two species of the genus *Metabinuncus*, *M. irangiensis* (Fain) and *M. javanicus* Fain, are known only from the male. It is highly probable that *M. javanicus* Fain is the partner male of *M. birmanicus* Fain, which is known from the female. Thus, the comparison of the present mite and female of *M. irangiensis* is necessary in future. The authors presume that both the mites can not be conspecific because of differences in geographical ranges and hosts.

6. *Hipposiderobia phyllorhinae* Fain, 1972

Material examined. One ♀ and 2 nymphs, ex *Hipposideros diadema* (Geoffroy-St.-Hilaire), Poring, Sabah, Borneo, Malaysia, 1979·VIII·27.

This mite was described on the holotype female that was found on *Hipposideros diadema* from New Guinea (Fain, 1972, 1978a). The Bornean female bears some differently sized setae on the dorsum. Setal length in microns as follows: *ve*, 54; *sc e*, 85; *l*₁, 63; *d*₁, 25; *d*₂, 23; *l*₂, 18; *d*₃, 5; *l*₃, 13. The setae *d*₁, *d*₂ and *l*₂ are weakly barbed and thicker than *d*₄. The difference in length or nature of *sc e*, *l*₁ and *l*₂ is, however, ascribed to individual variation.

7. *Hipposiderobia inflasetosa* sp. nov.

Figs. 5–6

Material examined. Holotype male, allotype female, 4 pairs of male and female paratypes ex *Hipposideros galeritus labuanensis* (Tomes), Batu Puteh, Sabah, Borneo, Malaysia, 1979·III·20; 12 ♂♂, 12 ♀♀ from the same host with the above locality and date.

The holotype and allotype are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9324, 9325), and the other specimens in the collection of K.U.

Male (Fig. 5). Body 240 (220–240) μ long by 150 (140–150) μ wide. Setae *vi* minute and spiniform; *ve* uniquely inflated, 45 (43–48) μ long; *sc e* and *l*₁ in the same nature, 80 (80–91) and 70 (65–68) μ long, respectively; *d*₁ barbed and 15 (12–13) μ long, situated close to genital opening. Genital opening anterior to basal level of *l*₁; structure as in Fig. 5A. Penis thick and 65 (60–65) μ long. Ventral setation as in Fig. 5B. Legs and gnathosoma as in Fig. 5A and B. Tarsi I each with a pair of tiny claws. Clasping organ on genua I sharply pointed.

Female (Fig. 6). Body 295 (270–300) μ long by 182 (160–180) μ wide. Setae *vi* weakly barbed, 15 (13–15) μ long; *ve* inflated, 60 (55–60) μ long; *sc e* 98 (90–98) μ long; *d*₁, *d*₂, *l*₂, *d*₃ and *d*₄ minute but prominent, 15 (10–12), 13 (10–10), and 13 (8–10) μ

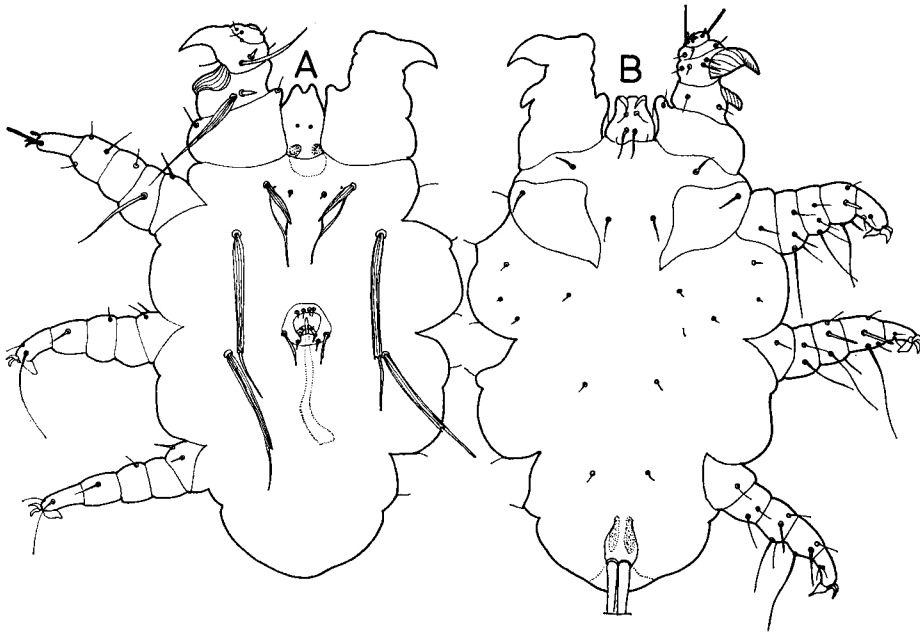


Fig. 5. *Hipposiderobia inflasetosa* sp. nov., male. A-dorsum; B-venter.

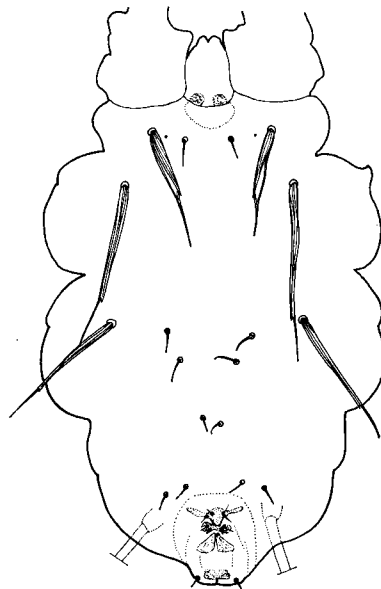


Fig. 6. *Hipposiderobia inflasetosa* sp. nov., female, dorsum.

long, respectively; l_1 as *sc e* in nature, 77 (65–73) μ long; d_1 situated slightly posterior to basal level of l_1 . Genito-anal region as in Fig. 6. Venter, legs and gnathosoma essentially as in male.

The present new mite is closely allied to *Hipposiderobia ceylonica* (Radford), a parasite of *Hipposideros galeritus brachyotis* (Dobson) in Ceylon, which is known only from the female. The opisthosomal submedian setation on the dorsum is, however, quite different in both the species. The setae are weaker and l_3 and d_5 are lacking on *H. inflasetosa* sp. nov.

The female of *H. inflasetosa* sp. nov. resembles that of *H. afer* Fain, but the males of both the species are easily separable from each other by the situation of the genital opening. Although the setal distribution on the dorsum is essentially the same on the females of *H. inflasetosa* sp. nov. and *H. asseliscus* Fain, the latter mite lacks paired claws on tarsus I and *cx* II_{1–2}. Lengths of setae *sc e* and l_1 are also different in the females of both the species.

8. *Hipposiderobia secunda* sp. nov.

Figs. 7–8

Material examined. Holotype male, allotype female and 4 pairs of male and female paratypes ex *Hipposideros galeritus labuanensis* (Tomes), Batu Puteh, Sabah, Borneo, Malaysia, 1979-III-20; 5 ♂♂, 15 ♀♀ from the same host with the above locality and date.

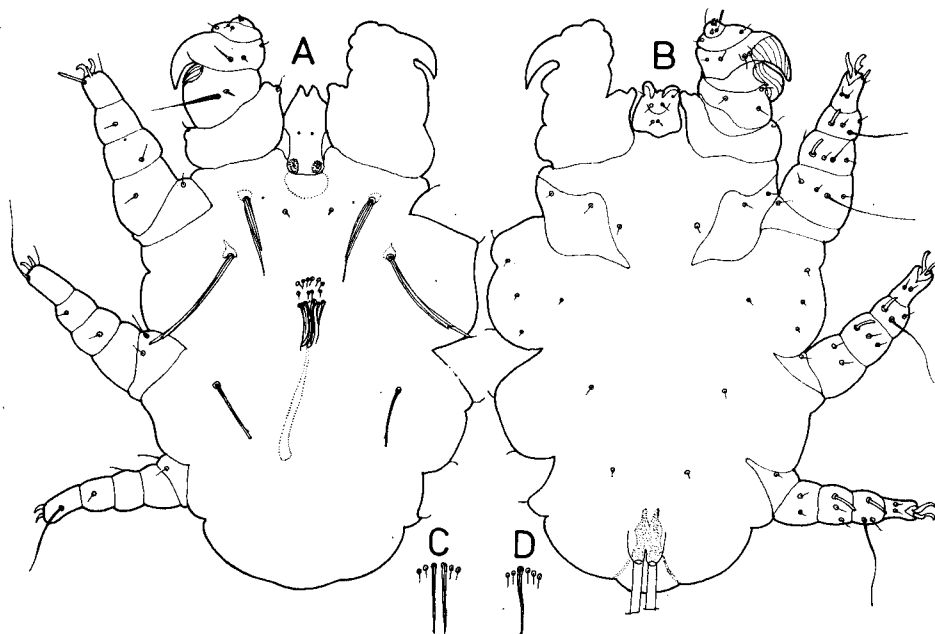


Fig. 7. *Hipposiderobia secunda* sp. nov., male. A- dorsum; B-venter; C, D-first row of genital setae.

The holotype and allotype are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9326, 9327).

Male (Fig. 7). Body 205 (200–240) μ long by 140 (135–145) μ wide. Setae *vi* minute; *ve* 38 (38–45) μ long; *sc e* 52 (47–55) μ long; *l*₁ relatively short, 28 (26–33) μ long. Genital opening at anterior third between *sc e* and *l*₁; *d*₁ and thickened, paired setae flanking opening; 2 rows of minute setae, with 3 and 2 pairs, present anteriorly from opening; innermost pair of first row variable in length; these setae minute on holotype, 2 paratypes and 4 other specimens (Fig. 7A), fine and about 25 μ long on a paratype and 2 other specimens (Fig. 7C), and one seta long and the other ones minute on a single specimen (Fig. 7D). Penis fine anteriorly, about 75 μ long. Ventral setation, legs and gnathosoma as in Fig. 7A and B. Paired minute claws on tarsus I.

Female (Fig. 8). Body 270 (220–260) μ long by 165 (150–170) μ wide. Setae *vi* minute, 8 (8–8) μ long; *ve* 48 (45–48) μ long; *sc e* 57 (50–58) μ long; *l*₁ 27 (30–33) μ long. Opisthosomal dorsal setae reduced; only *d*₁, *d*₂ and *l*₂ discernible on some specimens. Pretty sclerites on genito-anal region. Ventral setation, legs and gnathosoma as in male.

The present new species is characterized by the genital setae of the male and reduced *d* series of setae of the female, both of which are not common among the members of the genus *Hipposiderobia*. The new species resembles *H. ribensis* Fain that is known only from the male. The structure of the genital opening and form of the penis are differential characteristics for both the species.

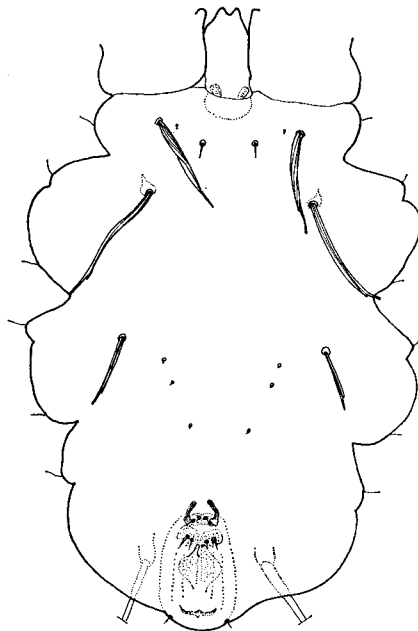


Fig. 8. *Hipposiderobia secunda* sp. nov., female, dorsum.

The mites of the genus *Hipposiderobia* usually lack claws on tarsus I. The four species distributed in the Oriental Region, *H. ceylonica* (Radford), *H. okinawaensis* Uchikawa, the preceding and present new species, are endowed reversely with a pair of tiny claws on leg I.

The structures of the genitalia and genital region serve as good criteria for identification of acarine species. The serial variation in nature of male genital setae of *H. secunda* sp. nov. is suggestive of the setal arrangement being more important than relative length of setae as a specific criterion.

The occurrence of *H. secunda* sp. nov. on *Hipposideros galeritus labuanensis* arouses our dual interest. The first is that a single host bat yielded the two different mites of the genus *Hipposiderobia*. This is the first case for the genus. The second is that both the species differ from *H. ceylonicus* (Radford) that occurred on *Hipposideros galeritus brachyotis* (Dobson) from Ceylon. It is empirically known that any myobiid mite is shared by several hosts that differ from one another in subspecies level. Accordingly, the Bornean and Ceylonese bats probably belong to separate taxa beyond the subspecies level judging from *Hipposiderobia* mites they harbour.

9. *Neomyobia plurihospitalis sabahensis* subsp. nov.

Fig. 9

Material examined. Holotype male, allotype female and 2 pairs of male and female paratypes, 2 ♂♂, 8 ♀♀ and 2 deutonymphs ex *Rhinolophus philippinensis* Waterhouse, Gomantong Cave, Sabah, Borneo, Malaysia, 1976-IX-10; 3 ♂♂, 23 ♀♀, a morphotype tritonymph and a larva from the same host, Madai Cave, Sabah, Borneo, Malaysia, 1979-VIII-11.

The holotype, allotype and morphotype are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9328-9330), and the other specimens in the collection of K.U.

Male (Fig. 9A). Measurements were taken from all the eight specimens and were given as ranges followed by means in parentheses.

Body 380-430 (400.0) μ long by 140-170 (155.5) μ wide. Setae *ve* 90-100 (95.1) μ long and 30-38 (33.8) μ wide at base; *sc e* 123-135 (129.9) μ long and 18-20 (18.4) μ wide; *d*₁₋₂ and *d*₄₋₅ 38-40 (38.7), 58-70 (65.4), 55-65 (61.3) and 30-34 (31.8) μ long, respectively; *l*₁ 135-180 (160.3) μ long and 13-15 (13.6) μ wide. Penis 173-190 (182.6) μ long. Ventral setae *ic*₁ fine; *ic*₂₋₄ long. Coxal setation: 2-3-0-0.

Female. Setal arrangement and measurements, structure of legs and gnathosoma essentially as in nominate form.

Tritonymph (Fig. 9B). Body 340 μ long by 140 μ wide. Setae *ve* 20 μ wide; opisthosomal setae *d*₁ and *d*₂ swollen and striated; *l*₂, *d*₃₋₅ distinctly thinner and shorter than *d*₁ and *d*₂.

Deutonymph and larva quite the same with those of nominate form.

The slightly longer *d*₁, distinctly shorter *d*₂ and *d*₅ twice as long as that of the nominate form are differential characteristics of the male of the new subspecies. Although the females, deutonymphs and larvae of the new and nominate subspecies

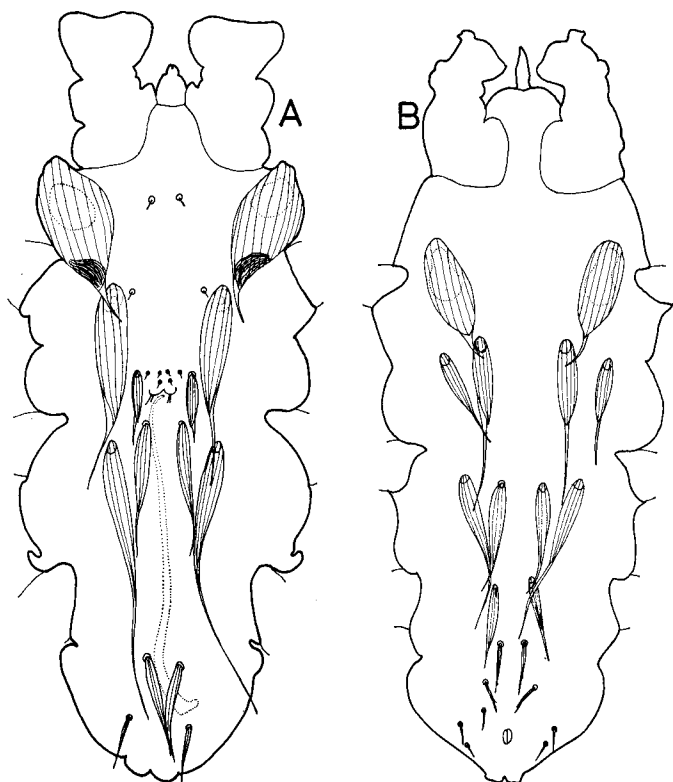


Fig. 9. *Neomyobia plurihospitalis sobahensis* subsp. nov. A-dorsum of male; B-dorsum of tritonymph.

could not be separated from each other, nature of some opisthosomal setae is different in both the subspecies in the tritonymphal stage. Setae d_{3-5} and l_2 are distinctly weaker in the new subspecies than in the nominate form.

The adult coxal setae of the second coxae of *Neomyobia aberrans* Uchikawa and *Neomyobia plurihospitalis* Uchikawa were erroneously enumerated as 2, instead of the real number of 3, pairs in the original description (Uchikawa, 1978a).

10. *Neomyobia brevipenis* sp. nov.

Figs. 10-11

Material examined. Holotype male, allotype female, 5 pairs of male and female paratypes, 8 ♂♂ and 4 ♀♀ ex *Rhinolophus creaghi* Thomas, Gomantong Cave, Sabah, Borneo, Malaysia, 1976·IX·10; 7 ♂♂, 11 ♀♀, collection data unknown, but taken on Sabah, Borneo, Malaysia, in 1976; 4 ♂♂, 1 ♀ ex *Rh. creaghi*, Madai Cave, Sabah, Borneo, Malaysia, 1979·VIII·14.

The holotype and allotype are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo, (NSMT-Ac 9331, 9332), and all the other specimens in the collection of K.U.

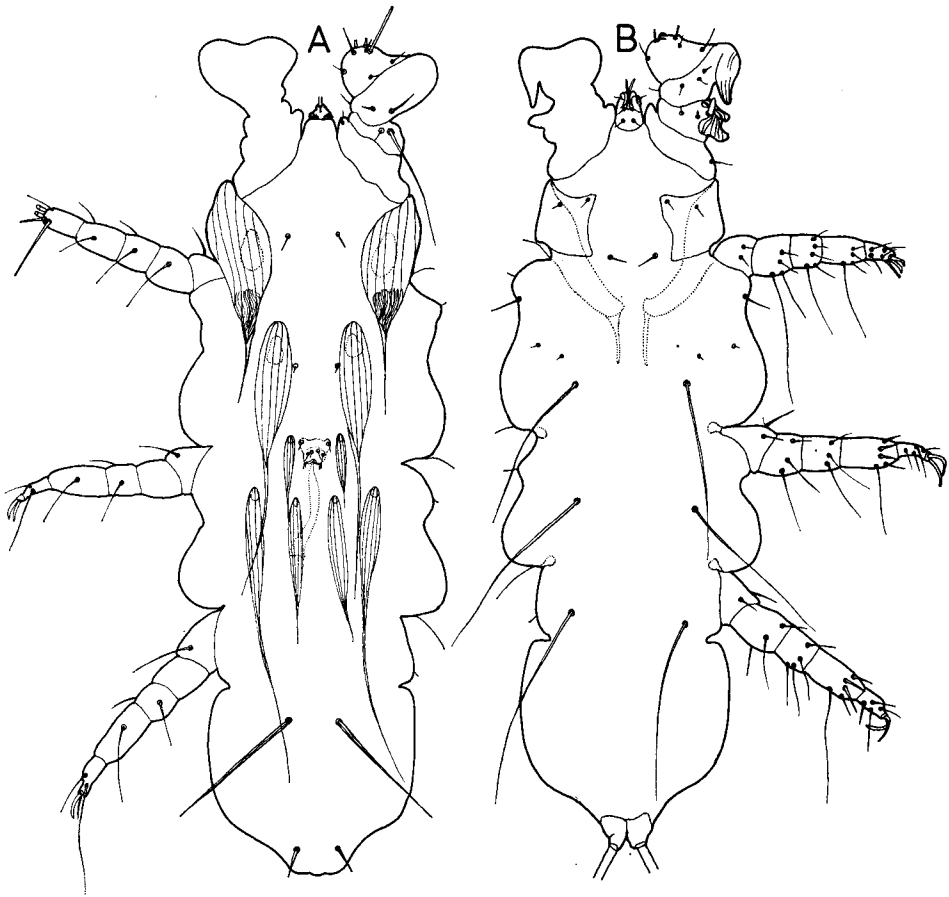


Fig. 10. *Neomyobia brevipenis* sp. nov., male. A-dorsum; B-venter.

Male (Fig. 10). Measurements for holotype are followed by ranges for 5 paratypes in parentheses.

Body 420 (400–440) μ long by 150 (140–156) μ wide. Setae *ve* strongly inflated basally, 110 (108–118) μ long and 43 (33–40) μ wide at base; *vi* 10 (8–10) μ long; *sc e* 145 (125–148) μ long; *sc i* very short, situated posterior to basal level of *sc e*; *l*₁ 165 (153–180) μ long; *d*₁ and *d*₂, 48 (43–48) and 85 (83–88) μ long, respectively; *d*₄ slenderer than *d*₁ and *d*₂, 92 (70–90) μ long; *d*₅ close to caudal margin, 25 (20–28) μ long; *l*₅ 420 (350–420) μ long. Genital opening slightly posterior to basal level of *d*₁; 3 pairs of minute setae on weak sclerite (=genital shield), and arranged as in Fig. 10A; 2 pairs of setae on postero-lateral corners of sclerite. Penis stout and short, sinuate weakly, 57 (53–63) μ long. Ventral setae *ic*_{2–4} long; coxal setation: 2-3-0-0. A pair of tiny claws ventrally on tibio-tarsus complex.

Female (Fig. 11). Measurements for allotype are followed by ranges for 5 paratypes.

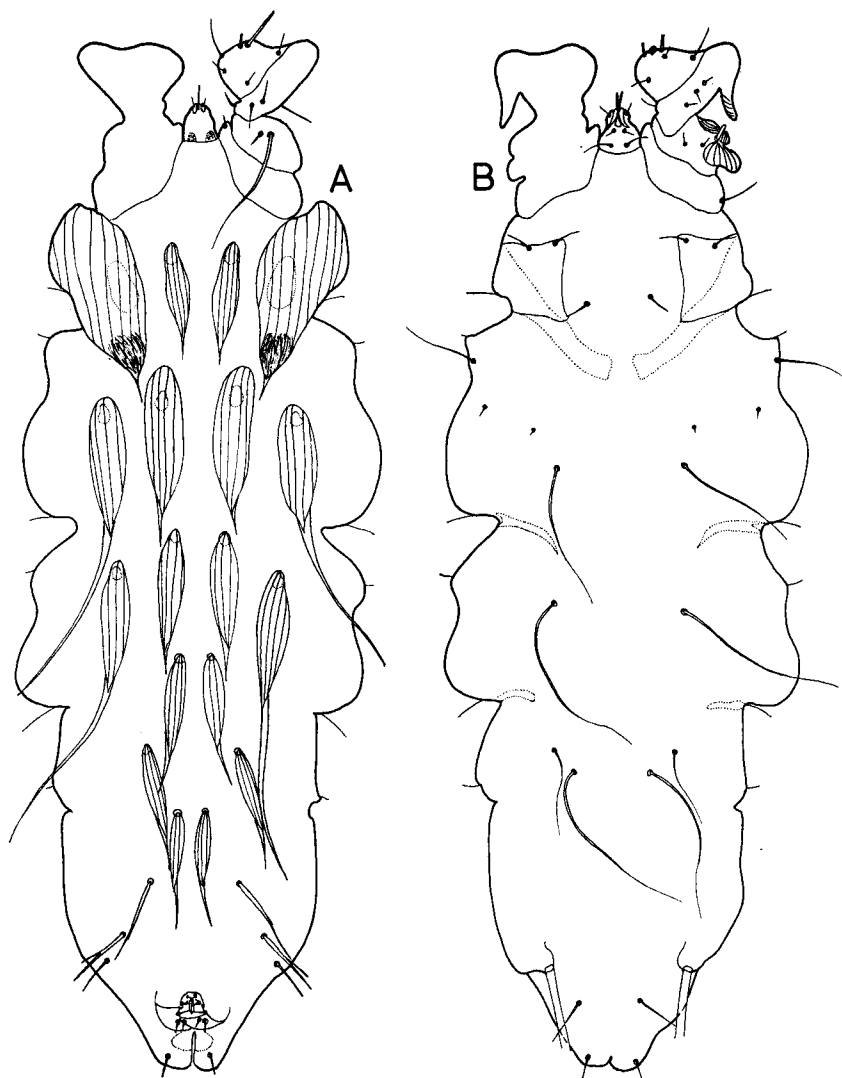


Fig. 11. *Neomyobia brevipenis* sp. nov., female. A-dorsum; B-venter.

Body 540 (500–580) μ long by 225 (200–210) μ wide. Setae *ve* 130 (120–130) μ long and 55 (38–48) μ wide at base; *vi* widest at middle, 76 (70–75) μ long; *sc e* 155 (143–158) μ long; *sc i* 103 (100–108) μ long; *l*₁ 195 (178–203) μ long; *d*₁ situated distinctly anterior to *l*₁, 87 (83–88) μ long; *d*₂, *l*₂ and *d*₃ subequal in length, 70–75 μ long; *d*₄ and *d*₅ slenderer than preceding setae, barbed and 60 (63–60) and 45 (35–43) μ long, respectively; *l*₄ 30 (20–28) μ long; *l*₅ 470 (430–450) μ long. Ventral setae *cxII*₃ fine and moderately long; *cxIV* well developed. Other structures and setation essentially as in male.

The most remarkable characteristics of *Neomyobia brevipenis* sp. nov. are the very

short penis and, in the female, the unique form of setae *vi* and well developed *cxIV*. The female of the new species is close to that of *Neomyobia birmana* Fain parasitic on *Rhinolophus affinis macrurus* Andersen on Burma and known only from the female. However, the size and situation of setae *g*₁ are different on both the mites, and the small sclerite is present ventrally only on *N. birmana* Fain. These differences are not so remarkable, but partner males are anticipated to bear quite different genitalia.

11. *Schizomyobia rwandae* Fain, 1972

Material examined. One ♀ ex *Tadarida plicata* (Buchannan), Gomantong Cave, Sabah, Borneo, Malaysia, 1976·IX·16; 2 ♂ ♂ from the same host and locality, 1979·IV·3.

Schizomyobia is the monotypic genus and its hosts are *Tadarida pumila* and *Tadarida* sp. from Nyakibanda and Bitare, Rwanda. The above are the first record from outside of Africa.

12. *Ewingana* (*Ewingana*) *bispinosa longispina* Fain et Lukoschus, 1979

Material examined. Twenty-five ♀ ♀ ex *Tadarida plicata* (Buchannan), Gomantong Cave, Sabah, Borneo, Malaysia, 1976·IX·10; 1 ♂, 11 ♀ ♀ from the same host and locality, 1976·IX·16.

Only a single specimen of the male beared setae and genital spicles somewhat shorter than those of the holotype of this subspecies (Fain et Lukoschus, 1979). Some measurements that are comparable with those for the holotype in parentheses are as follows: Body 440 (480) μ long by 180 (195) μ wide; *ve* 35 (45) μ long; *sc i* 23 (20) μ long; anterior genital spine 15 (18) μ long; long genital spicle 88 (100) μ long; *d*₁, *d*₂, *l*₂ and *d*₃ 23 (36), 30 (36), 78 (90–100) and 65 (75) μ long, respectively; penis 210 (200–225) μ long. These differences were regarded as intraspecific variations.

The type host is *Tadarida jobensis* (Miller) from Mount Hart, Australia.

13. *Ugandobia balionycteris salomonensis* Fain, 1976

Material examined. Eleven ♂ ♂ and 29 ♀ ♀ ex *Emballonura rivalis* Thomas, Poring, Sabah, Borneo, Malaysia, 1979·III·23.

Male. Measurements for 6 specimens are presented as ranges.

Body 250–290 μ long by 125–135 μ wide. Setae *ve* 65–70 μ long and 9–10 μ wide; *vi* minute; *sc e* 88–95 μ long and 7–8 μ wide; *sc i* minute, situated slightly anterior from basal line of *sc e*; *l*₁ 88–100 μ long and 7–8 μ wide; *d*₁ barbed, 17–20 μ long, and situated on level slightly posterior to bases of *sc e*; *l*₂ minute, situated posterior to *l*₁; *d*_{3–5} close to one another, subequal in length, 11–12 μ long. Penis about 140 μ long. Coxal setation 2-2-0-1; *ic*₄ slightly longer than *cxIV*. Gnathosoma 23–25 μ long, inclusive of palpi, by 15–20 μ wide at base.

Female. Body 350–375 μ long by 155–170 μ wide. Setae *ve* 67–73 μ long and 10–11 μ wide; *sc e* 70–80 μ long and 7–9 μ wide; *sc i* situated anterior to *sc e*, 68–73 μ long and 6–7 μ wide; *l*₁ 83–95 μ long and 6–8 μ wide; *d*₁, *d*₂ and *l*₂ same in nature,

33–36, 30–33 and 25–30 μ long, respectively; d_3 – d_5 barbed; l_3 situated slightly anterior to d_3 on some specimens, but usually postero-laterad from d_3 . Setae on genito-anal region fine and prominent. Ventral setae ic_1 – ic_4 17–23, 28–33, 35–40 and 13–18 μ long, respectively; $cxIV$ 11–13 μ long. Gnathosoma 25–25 μ long, inclusive of palpi, and 23–24 μ wide at base.

Ugandobia balionycteris salomonensis Fain described only on the females was found on *Emballonura dianea* taken on Solomon and deposited in the collection of British Museum. Although it is very difficult to identify some myobiids with species known only from the females, no conspicuous characteristic to separate the above described mite from *U. balionycteris salomonensis* was found out.

14. *Calcarmyobia miniopteris* (Womersley, 1941)

Material examined. Three ♂♂, 4 ♀♀ ex *Miniopterus magnater* Sanborn*, Madai Cave, Sabah, Borneo, 1976·IX·16; 8 ♂♂, 13 ♀♀, 7 nymphs, 1 larva from the same host and locality, 1979·VIII·12–14; 2 ♂♂, 1 ♀, 1 N from the same host, Park Headquarters, Kinabalu, Sabah, Borneo, Malaysia, 1979·III·17.

This mite was reported from Japan under the name *japonica* as a parasite of *Miniopterus schreibersi fuliginosus* Hodgson (Uchikawa, 1976), and, then, was synonymized with *miniopteris* that parasitizes *M. schreibersi* (Kuhl) in South Australia by Fain and Lukoschus (1979).

15. *Calcarmyobia* sp.

Material examined. Sixteen ♂♂, 15 ♀♀ ex *Miniopterus australis* Tomes, Madai Cave, Sabah, Borneo, Malaysia, 1976·IX·16; 15 ♂♂, 12 ♀♀, 4 nymphs and a larva from the same host and locality, 1979·VIII·12.

The present anonymous species appeared first in Fain and Lukoschus (1979), and its host was reported to be *Miniopterus australis* from Queensland, Australia.

16. *Calcarmyobia hamata* sp. nov. Figs. 12–13

Material examined. Holotype male, allotype female, 5 male paratypes, 4 female paratypes, 6 ♂♂, 3 ♀♀, 5 nymphs and 1 larva ex *Miniopterus schreibersi* (Kuhl), Madai Cave, Sabah, Borneo, Malaysia, 1979·VIII·13.

The holotype and allotype are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo, (NSMT-Ac 9333, 9334), and the other specimens in the collection of K.U.

Male (Fig. 12). Measurements for holotype are followed by ranges for 5 paratypes in parentheses.

Body 480 (490–500) μ long by 195 (195–210) μ wide. Setae *ve* 197 (200–210) μ

* This species was formerly treated as *M. schreibersi magnater* Sanborn, 1931. Now the authors have come to the conclusion that it must be treated as distinct species. Detailed taxonomical discussions will appear in the preparing paper “Maeda, K., M. Harada and T. Kobayashi: On the classification of *Miniopterus* in Madai Cave, Sabah, East Malaysia”.

long and maximum width 43 (45–47) μ ; *vi* 115 (113–123) μ long and 30 (31–33) μ wide, with tail gradually tapered; *sc e* 173 (165–173) μ long, 20 (20–20) μ wide; *sc i* 68 (70–74) μ long, 13 (13–15) μ wide; *d*₁ slightly swollen and tapered gradually, 35 (35–38) μ long; *d*₂ swollen, barbed, striated and tapered abruptly, 40 (32–38) μ long; *d*₄ 44 (45–57) μ long; *d*₅ 73 (70–78) μ long; *l*₁ 165 (145–167) μ long, 15 (15–17) μ wide. Penis sinuate, 135 (135–140) μ long. Genital region, inclusive of *d*₁ and *d*₂, as in Fig. 12A. Intercoxal setae *ic*_{2–4} long; coxal setation: 2-3-0-1. Leg II with a pair of well developed claws, one of which bears a prominent hook at basal third; antero-lateral seta on genu I thickened and sickle-like (Fig. 12B).

Female (Fig. 13). Measurements were taken from allotype and 4 paratypes.

Body 585 (590–630) μ long by 270 (275–300) μ wide. Setae *ve* 190 (175–185) μ long, 52 (48–52) μ wide; *vi* 117 (103–125) μ long, 34 (33–35) μ wide; *sc e* 210 (200–208) μ long, 35 (31–35) μ wide; *sc i* 115 (105–113) μ long, 18 (15–16) μ wide; *d*₁ 58 (55–62) μ long, 18 (17–19) μ wide, and *d*₁–*d*₁ 50 (50–53) μ ; *d*₂ 70 (73–75) μ long, 18 (16–17) μ wide and *d*₂–*d*₂ 25 (24–27) μ ; *d*₃ situated on level anterior to bases of *l*₂, 100 (93–97) μ long, 17 (15–18) μ wide; *d*₄ 95 (80–90) μ long, 18 (17–18) μ wide; *d*₅ fine and 81 (75–80) μ long; *l*₁ 204 (183–195) μ long, 20 (18–20) μ wide; *l*₂ 90 (80–88) μ long, 18 (16–18) μ wide. Genital setae *g*₁ 50 (45–48) μ long. Prominent scale dorso-laterally on mid-level between *d*₄ and *d*₅.

The mites of the genus *Calcarmyobia* closely resemble one another, especially in the female. The females of the three species distributed in Australia, Borneo and Japan, *C. miniopteris*, *Calcarmyobia* sp. and *C. hamata* sp. nov., are separable from African *C. rhinolophia* (Radford) and European species by nature of the anal setae *ai*, which are clavate in the former three and simple in the latter. It is barely possible to differentiate the female of *Calcarmyobia hamata* sp. nov. from those of *Calcarmyobia* sp. and *Calcarmyobia miniopteris* basing on relative length of the setae *d*₃ and *l*₂, and situation of the opisthosomal scales. The setae *d*₃ are slightly longer than *l*₂ only in the new species. The opisthosomal scales are situated dorso-laterally on the new species (Fig. 13A), laterally on *C. miniopteris* (Fig. 13B), and are lacking on *Calcarmyobia* sp. (Fig. 13C). Contrary to the above subtle differences in the females, the males of all the known species are

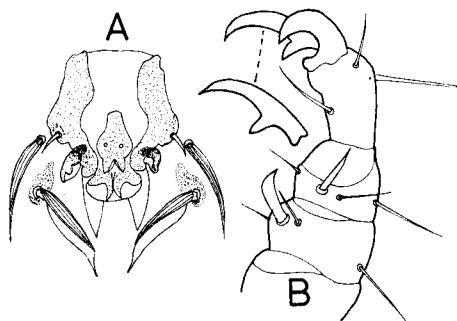


Fig. 12. *Calcarmyobia hamata* sp. nov., male. A-genital region; B-leg II.

easily separated by combination of the following characteristics: Structure of the genital region, inclusive of accessory setae d_1 and d_2 , claws on tarsus II and modified, antero-lateral seta on genu II. The inflated, short d_1 , well developed and hooked claw and sickle-like modified seta are characteristic of only the male of the present new species.

The mites of the genus *Calcarmyobia* are not monoxenic, that is, any mite can be shared by 2 or more closely allied bats of the genus *Miniopterus*. On the other hand, it is difficult to presume that the mites are synhosipitalic on a single host bat. Accordingly, the occurrence of the three different mites on respective hosts sympatric in Madai Cave, Borneo, supports the validity of the host bats, and indicates that Bornean, European and Japanese *M. schreibersi* bats are not conspecific, though they have been named the same, only annexing different subspecies names for some forms. Speciation of any parasite is thought to be facilitated through formation of host species. Although many *Miniopterus* forms are morphologically very close to one another, their speciation might have accomplished sufficiently to bring forth the speciation of the parasitic mites.

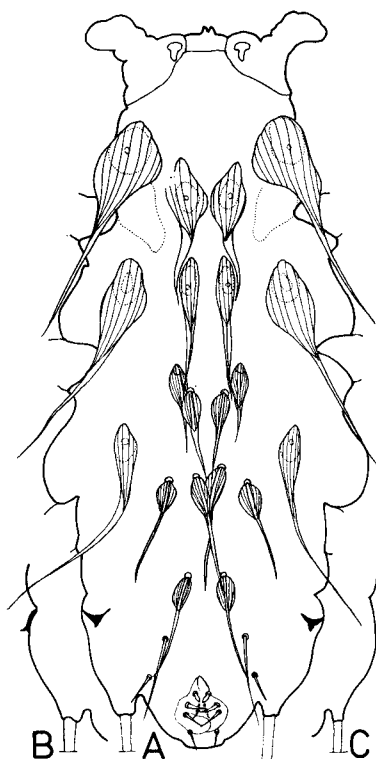


Fig. 13. *Calcarmyobia hamata* sp. nov., female. A-dorsum. *Calcarmyobia miniopterus* (Wormersley), female. B-posterolateral part. *Calcarmyobia* sp., female. C-postero-lateral part.

17. *Pteracarus miniopteri* Uchikawa, 1978

Material examined. Five ♂♂, 7 ♀♀ ex *Miniopterus schreibersi* (Kuhl), Madai Cave, Sabah, Borneo, Malaysia, 1979·VIII·9–13.

This mite was described on the holotype male and allotype female taken from *Miniopterus schreibersi* (Kuhl) from Yugoslavia (Uchikawa, 1978c). The present record is the second one for the mite.

18. *Pteracarus faini* Uchikawa, 1978

Material examined. Two ♀♀ ex *Miniopterus australis* Tomes, Gomantong Cave, Sabah, Borneo, Malaysia, 1976·IX·10; 7 ♂♂ 1 ♀ from the same host, Madai Cave, Sabah, 1976·IX·16; 6 ♂♂, 2 ♀♀ from the same host and locality, 1979·VIII·12; 1 ♂ ex *Miniopterus magnater*, Sanborn*, Madai Cave, Sabah, 1976·IX·16; 13 ♂♂, 5 ♀♀ from the same host and locality, 1979·VIII·11–12.

The mites of the genus *Pteracarus* are usually shared by several allied host bats (Dusbábek, 1973). The structure of the male genitalia is conservative and indicative of affinity of mites infesting closely allied host bats (Dusbábek, 1973; Uchikawa, 1978c). Thus, these mites serve as indices for grouping phylogenetically close host species.

The Bornean 3 *Miniopterus* bats that yielded the 3 *Calcaromyobia* species harbored *Pteracarus miniopteri* Uchikawa and *Pteracarus faini* Uchikawa. This indicates that the Bornean host, *Miniopterus schreibersi*, and European bat of the same name are phylogenetically close, though both the forms should be regarded as different taxa as shown above taking the case of the *Calcaromyobia* mites.

The other mite, *Pteracarus faini*, that is parasitic on Japanese *Miniopterus schreibersi* (Uchikawa, 1978b) occurred on *Miniopterus australis* and *Miniopterus magnater* on Borneo. Thus, these 3 bats so far known as hosts of the mite represent another species group.

Though recording Bornean *Pteracarus* and *Calcaromyobia* mites, it is noticed that the specific name of bats, *schreibersi*, might have been adopted too easily and extensively. The accurate definition for *schreibersi* should be introduced based on various informations, inclusive of morphological ones. It is reasonable to propose an availability of myobiid mites as one of such the informations as above.

19. *Pteracarus pusillus thailandensis* Uchikawa et Kobayashi, 1979

Material examined. Two ♂♂, 8 ♀♀ and 1 nymph ex *Scotophilus temmincki cantaneus* Gray, Penampang, Sabah, Borneo, Malaysia, 1979·VIII·29.

20. *Pteracarus dusbabeki* sp. nov. Figs. 14–15

Material examined. Holotype male, allotype female, a pair of male and female paratypes ex *Myotis horsfieldi* (Temminck), Madai Cave, Sabah, Borneo, Malaysia, 1979·VIII·14; a paratype male from the same host, Batu Puteh Cave, Sabah, Borneo, Malaysia, 1979·IV·1; a paratype female from the same host and locality, 1979·IV·1;

* Synonym of *M. schreibersi magnater*. See foot-note on the page 111.

2 paratype males from the same host, Madai Cave, Sabah, Borneo, Malaysia, 1979-VIII.9.

The holotype and allotype are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9335, 9336) and the other specimens in the collection of K.U.

Male (Fig. 14). Measurements were taken from all the type specimens.

Body 245 (240–245) μ long by 150 (150–150) μ wide. Setae *ve* 68 (53–60) μ long; *vi* very minute; *sc e* 100 (83–97) μ long; *sc i* minute but conspicuous, situated very slightly anterior from bases of *sc e*; *l*₁ 97 (85–93) μ long. Genital opening situated distinctly posterior to bases of *sc e*; genital shield and setation on it as illustrated in Fig. 14A. Penis long. Ventral setae as in Fig. 14B; *ic*₁–*ic*₁ 25 (25–30) μ ; *ic*₂–*ic*₂ 55 (48–55) μ ; *ic*₃–*ic*₃ 85 (85–91) μ ; *ic*₄ 8(8–10) μ long, still slightly longer than *cx*IV,

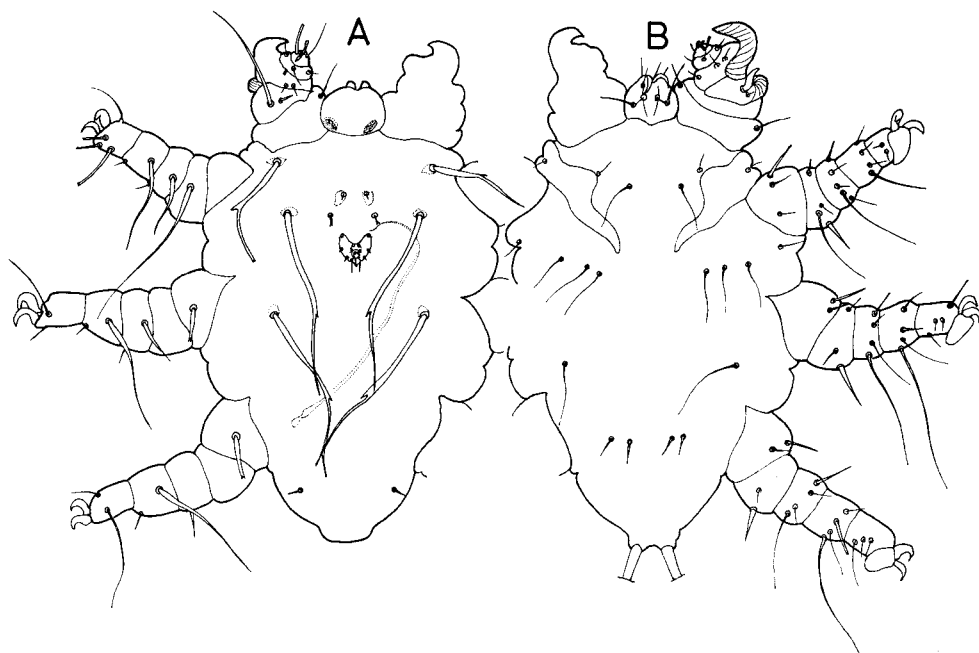


Fig. 14. *Pteracarus dusbabeki* sp. nov., male. A-dorsum; B-venter.

and apart 22 (20–25) μ from each other. Genu IV with 5 setae, dorsal seta lacking; dorsal seta on tibia IV about 50 μ long; ventral spine on tibia IV 10 μ long; a pair of claws on leg I.

Female (Fig. 15). Measurements are on allotype and 2 paratypes.

Body 320 (340–320) μ long by 230 (240–345) μ wide. Setae *ve* 80 (78–85) μ long; *vi* short but conspicuous; *sc e* 135 (130–135) μ long; *sc i* as *vi* in nature but minute, situated on very slightly posterior level to bases of *sc e*; *l*₁ 133 (145–?) μ long; *d*_{1–3} lacking; *d*_{4–5} short; *l*_{3–4} 20 (18–18) and 15 (18–16) μ long, respectively. Distance between *ic*₁ 50 (52–50) μ ; *ic*₂–*ic*₂ 80 (88–85) μ ; *ic*₃–*ic*₃ 125 (133–130) μ ; *ic*₄–*ic*₄ 40 (38–38) μ .

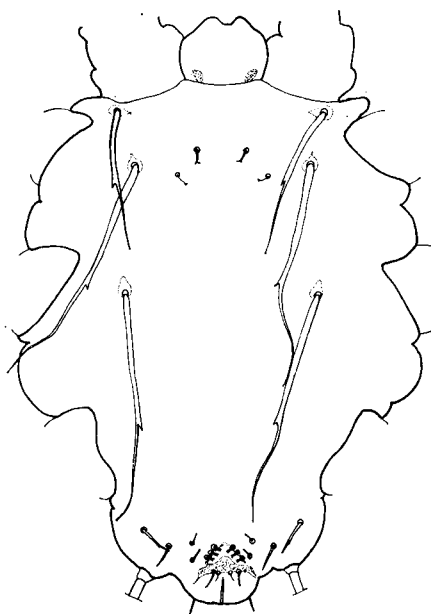


Fig. 15. *Pteracarus dusbabeki* sp. nov., female, dorsum.

Dorsal seta on tibiae III and IV about 85 and 80 μ long, respectively; dorsal seta on genu II distinctly shorter than seta on tibia III. Other structure as in male.

The present new mite is close to *Pteracarus minutus* subsp. parasitic widely on *Myotis* spp. The number of genital setae is, however, distinctly reduced in the new species. This property is one of the most important differential criteria for *P. dusbabeki* sp. nov.

Fain (1978a) presented *Pteracarus peruvianus* Fain on the holotype female from *Thyroptera discifera* from Peru. The female of *P. dusbabeki* sp. nov. is barely separable from *P. peruvianus* by the nature of the dorsal seta on tibia IV, which is regularly cylindro-conical only on the latter species.

Dusbábek (1973) recorded two females of an anonymous species, *Pteracarus* sp. F, from *Myotis horsfieldi* taken at Ampang Res., Kuala Lumpur, Malaysia. Although detailed morphological accounts for his 2 specimens are unknown, these specimens probably belong to *P. dusbabeki* sp. nov. Thus, Dr. Dusbábek could notice first the subsistence of the new species, and this led the authors to name the mite after him.

21. *Acanthophtirius* (*Myotimyobia*) *scotophili* Uchikawa et Kobayashi, 1979

Material examined. Ten ♂♂, 15 ♀♀ ex *Scotophilus temmincki castaneus* Gray, Penampang, Sabah, Borneo, Malaysia, 1979·VIII·29.

The type host of this mite is *Scotophilus kuhli* Leach from Thailand (Uchikawa et Kobayashi, 1979). Although the specific name refers to the genus of the host bat,

this *Acanthophthirius* mite is thought to be monoxenic as in cases of almost all species of the genus. The occurrence of the mite on *Scotophilus temmincki* on Borneo strongly suggests that the 2 specific bat names, *temmincki* and *kuhli*, are synonymous with each other.

22. *Acanthophthirius* (*Myotimyobia*) *adversus* Fain, 1978

Fig. 16

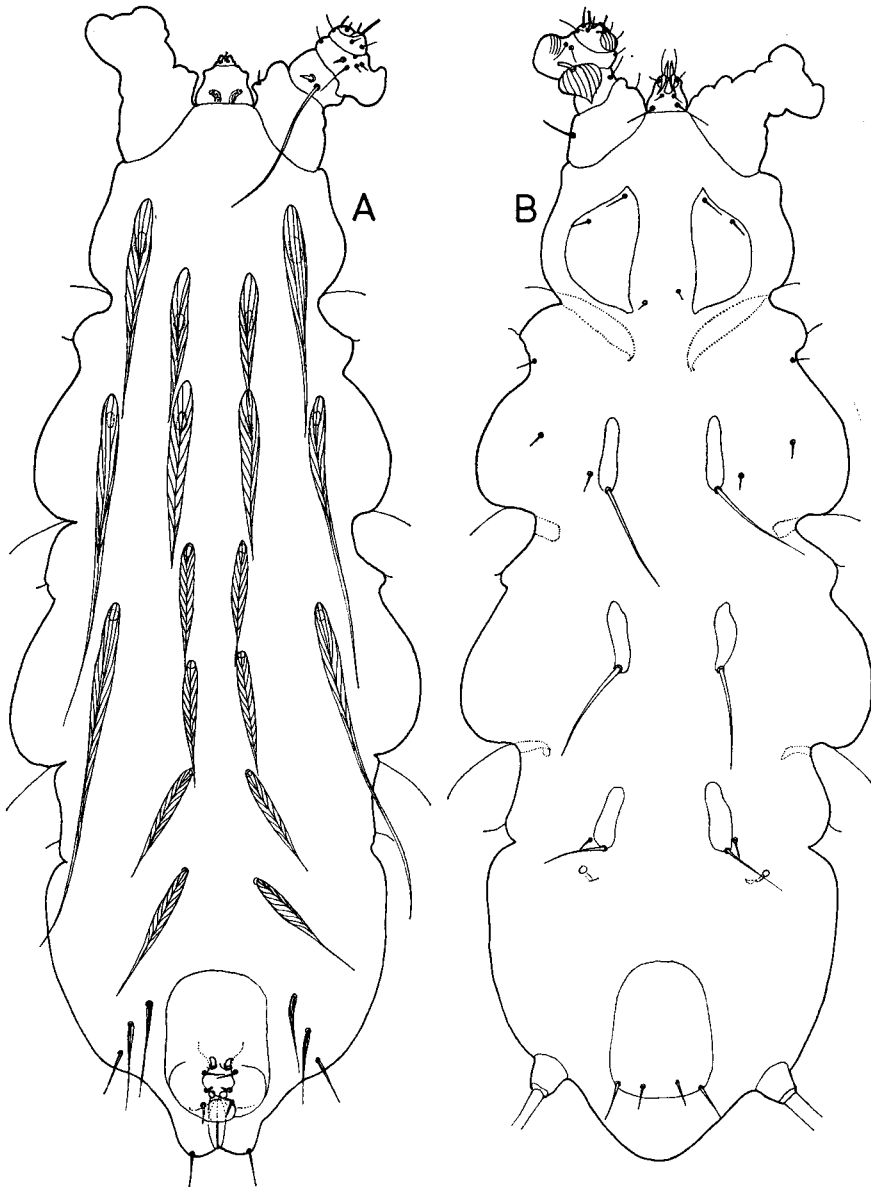


Fig. 16. *Acanthophthirius* (*Myotimyobia*) *adversus* Fain, female. A-dorsum; B-venter.

Material examined. Plesiotype female, 1 ♀, 2 ♂♂ ex *Myotis horsfieldi* (Temminck), Madai Cave, Sabah, Borneo, Malaysia, 1976·IX·16; 5 ♂♂, 11 ♀♀ from the same host, Madai Cave, Sabah, Borneo, Malaysia, 1979·VIII·9; 1 ♂ from the same host, Batu, Puteh Cave, Sabah, 1979·IV·1. The plesiotype is deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9337).

This species was described on the male taken from *Myotis adversus* Horsfield collected at Ambone, Indonesia, and deposited in the collection of British Museum (Fain, 1978b). The plesiotype female is designated, and description for the female is presented below.

As in the case of the above *Acanthophthirius* (*Myotimyobia*) *scotophili* Uchikawa et Kobayashi, *A. (M.) adversus* Fain from Bornean *Myotis horsfieldi* probably suggests that the two bats are conspecific.

Medway (1965) showed, however, a remarkable morphological difference between *M. adversus* and *M. horsfieldi*, and possibility of sympatric distribution of both bats in Sandakan District on the base of 2 specimens of *M. adversus*. When the difference of

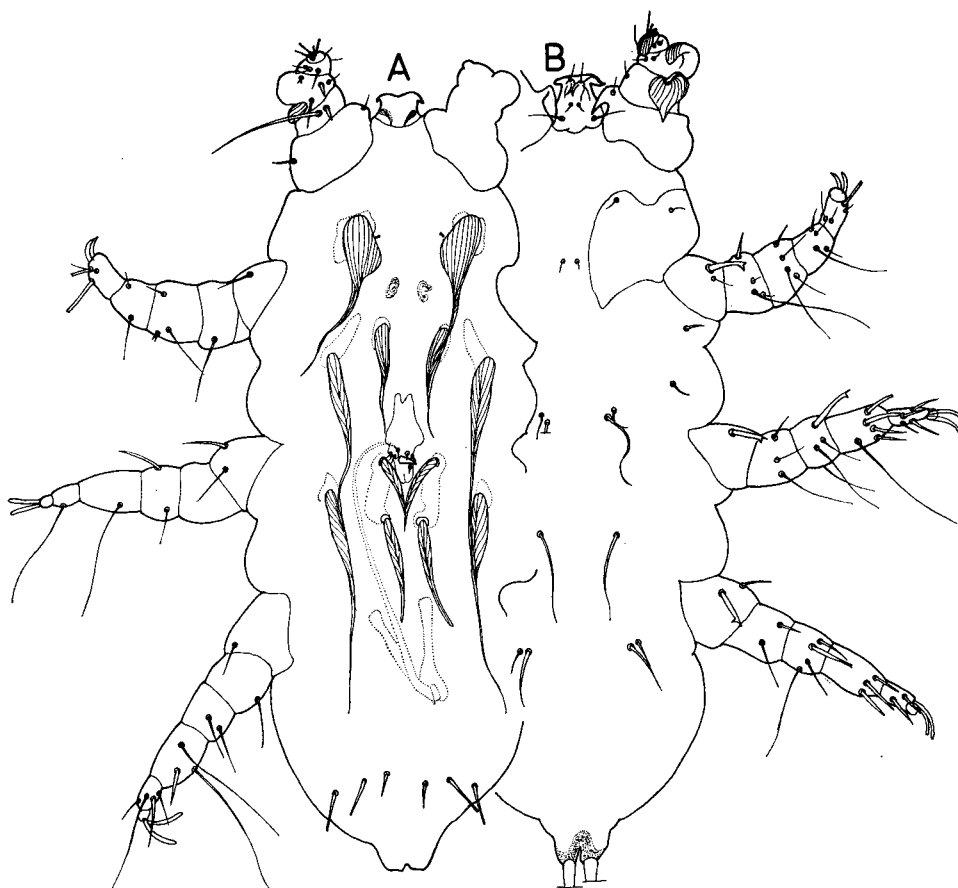


Fig. 17. *Acanthophthirius* (*Myotimyobia*) *mirabilis* sp. nov., male. A-dorsum; B-venter.

some host bats is of the subspecies level, such bats are usually expected to share an *Acanthophthirius* mite.

Female (Fig. 16). Plesiotype measured $580\ \mu$ long by $220\ \mu$ wide. Setae *ve* $120\ \mu$ long; *vi* $75\ \mu$ long; *sc e* and *sc i* 153 and $98\ \mu$ long, respectively; *l*₁ $183\ \mu$ long; *d*₁, *d*₂, *l*₂ and *d*₃ thickened and striated, 65 , 65 , 68 and $75\ \mu$ long, respectively; *d*₄, *d*₅ and *l*₄ swollen and striated basally, 53 , 48 and $33\ \mu$ long, respectively; *l*₅ about $205\ \mu$ long. Not annulated area anterior to genito-anal region. Intercoxal setae *ic*₂–*ic*₄ prominent, 65 , 65 and $35\ \mu$ long, respectively; *cx*IV minute. A pair of circular sclerites of $5\ \mu$ in diameter postero-laterad from *ic*₄. Legs and gnathosoma essentially as in male.

23. *Acanthophthirius* (*Myotimyobia*) *mirabilis* sp. nov.

Figs. 17–18

Material examined. Holotype male, allotype female and 3 paratype females ex

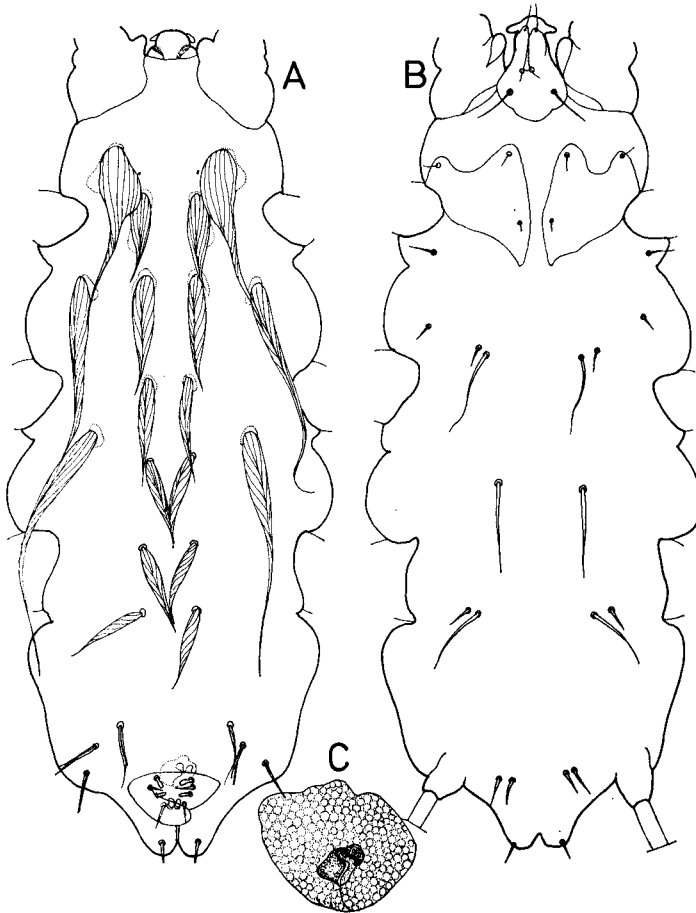


Fig. 18. *Acanthophthirius* (*Myotimyobia*) *mirabilis* sp. nov., female. A-dorsum; B-venter; C-embedded disc.

Myotis macrotarsus Waterhouse, Madai Cave, Sabah, Borneo, Malaysia, 1979-VIII-13.

The allotype is deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo (NSMT-Ac 9338), and the other types in the collection of K.U.

Male (Fig. 17). Holotype measured 550 μ long by 210 μ wide. Setae *ve* inflated basally, 133 μ long and 48 μ wide; *sc e* 168 μ long, 13 μ wide; *sc i* 75 μ long; *d*₁ and *d*₂ stout, 55 μ and 80 μ long, respectively; *l*₁ 173 μ long; *d*₄, *d*₅ and *l*₄ same in nature, 22, 30 and 30 μ long, respectively. Genital opening anterior to bases of *l*₁; genital shield as in Fig. 17A. Penis rather stout, about 225 μ long. Intercostal setae *ic*₁ minute; *ic*₂ about 55 μ long; *ic*₃ 58 μ long; *ic*₄ about 45 μ long. Gnathosoma ventrally with antero-lateral processes. Claws on leg I minute; trochanter I with sharp antero-lateral hook; solenidion on genu I bifid. Trochanters II–IV each with ventral seta with 2 tined tip; one seta of the same nature each ventrally on gennae III and IV; 2 setae ventrally on tarsi III and IV also with weakly bi-tined tips. Solenidion on genu II prominent and bifid.

Female (Fig. 18). Measurements were taken from allotype and 3 paratypes.

Body 590 (590–605) μ long by 240 (240–250) μ wide. Setae *ve* inflated basally, about 140 μ long, 28 (25–30) μ wide; *vi* 66 (64–65) μ long, 15 (14–17) μ wide; *sc e* 175 (175–185) μ long, 13 (15–16) μ wide; *sc i* 87 (79–84) μ long, 15 (13–14) μ wide; *d*₁ 83 (73–78) μ long, 15 (12–13) μ wide; *d*₂, *l*₂ and *d*₃ subequal in size, 65–68 μ long and about 10 μ wide; *d*₄ with slender tail, 53 (55–57) μ long; *d*₅ and *l*₄ abruptly ended, 45 (40–48) and 38 (38–38) μ long, respectively; *l*₁ 198 (210–215) μ long. Genito-anal region as in Fig. 18A; setae very short; pale orange sclerite surrounded by disc embedded (Fig. 18C). Relative length of *ic*_{1–4} as in male. Other structures essentially as in male.

The present new species is distinctive in having the gnathosoma with processes, hooked trochanter I, inflated *ve* and curious female embedded disc.

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Addresses of the authors:

(Mr) Kimito Uchikawa 内川公人

Department of Parasitology, Faculty of Medicine, Shinshu University 信州大学医学部寄生虫学教室
Matsumoto, JAPAN 390 松本市旭町3-1-1

(Mr) Kishio Maeda 前田喜四雄

Department of Anatomy, Gifu College of Dentistry 岐阜歯科大学口腔第一解剖学教室
Hozumi-cho, Gifu-ken, JAPAN 501-02 岐阜県穂積町高野

(Mr) Masashi Harada 原田正史

Laboratory of Experimental Animals, Osaka City University Medical School
大阪市立大学医学部実験動物研究室
Abeno, Osaka, JAPAN 545 大阪市阿部野区旭町1-4-54

(Mr) Tsuneaki Kobayashi, D Agr 小林恒明

Biological Laboratory, Yoshida College, Kyoto University 京都大学教養部生物学教室
Yoshida, Sakyo-ku, Kyoto, JAPAN 606 京都市左京区吉田二本松町